



US005530518A

United States Patent

[19]

[11] Patent Number:

5,530,518**Ushida et al.**

[45] Date of Patent:

Jun. 25, 1996**[54] PROJECTION EXPOSURE APPARATUS****[75] Inventors:** Kazuo Ushida; Masaomi Kameyama,
both of Tokyo, Japan**[73] Assignee:** Nikon Corporation, Tokyo, Japan**[21] Appl. No.:** 370,216**[22] Filed:** Dec. 7, 1994**Related U.S. Application Data****[63]** Continuation of Ser. No. 274,369, Jul. 13, 1994, abandoned,
which is a continuation-in-part of Ser. No. 166,153, Dec. 14,
1993, abandoned, which is a continuation of Ser. No.
991,421, Dec. 16, 1992, abandoned.**[30] Foreign Application Priority Data**

Dec. 25, 1991 [JP] Japan 3-343601

[51] Int. Cl.⁶ H01L 21/027; G03F 7/20**[52] U.S. Cl.** 355/53; 355/67; 355/71**[58] Field of Search** 355/43, 53, 71,
355/67**[56] References Cited****U.S. PATENT DOCUMENTS**

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A projection exposure apparatus includes illuminating optical means for illuminating a projection negative, and projection optical means for projection-exposing the projection negative illuminated by the illuminating optical means onto a substrate, the illuminating optical means including light source means for supplying exposure light, annular light source forming means for forming an annular secondary light source by the light from the light source means, and condenser means for condensing the light beam from the annular light source forming means on the projection negative, and is designed to satisfy the following condition:

$$\frac{1}{2} \leq d_1/d_2 \leq \frac{3}{4},$$

where d_1 is the inner diameter of the annular secondary light source, and d_2 is the outer diameter of the annular secondary light source.